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LIMITED SLIP DIFFERENTIAL
[Suberi seigen sadou souchi]

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Specification /1*

1. Title of the Invention

Limited Slip Differential

2. Claim(s)

With respect to a limited slip differential that consists of a pinion shaft, a pinion gear supported rotatably against the pinion shaft, a pair of side gears that are engaged with the pinion gear, a differential casing that contains the pinion shaft, pinion gear, and side gears, a clutch plate that is disposed between the side gears and differential casing and the outer periphery of which is engaged with the differential casing side, and a slip-limiting multidisc clutch that has clutch discs whose inner peripheries are engaged with the side-gear side,

a limited slip differential characterized by being equipped with an adaptor that has: a pressing part which is disposed in the space between the side-gear side and clutch discs, which rotates together with the side gears, and which transmits the thrust forces of the side gears to the multidisc clutch; and an engaging part that engages with the inner periphery part of the clutch disc.

3. Detailed Description of the Invention

(A) Field of Industrial Application

This invention relates to a limited slip differential for an automobile or the like.

(B) Technical Background and Problems Thereof

An example of conventional limited slip differentials is illustrated

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* Numbers in the margin indicate pagination in the foreign text.

in Figure 2. A ring gear (located outside the figure) interlocked and linked with the drive shaft (located outside the figure), which is the drive side, is affixed to a differential casing 101 and thus rotates together with the ring gear and differential casing 101.

Meanwhile, a pinion shaft 103, which is supported against the differential casing 101 on both ends, has attached to it a pair of rotatable pinion gears 105. Side gears 107 that function as a pair of output gears engaged with the pinion gears 105 are rotatably disposed inside the differential casing 101. Moreover, the side gears 107 are interlocked and linked with an axle (located outside the figure) that is connected to wheels (located outside the figure) by means of spline connection.

Moreover, a multidisc clutch 109 is disposed in the space /2 between the side gear 107 and differential casing 101. This multidisc clutch 109 is constructed by alternately assembling a clutch disc 111, which is connected to the side gears 107 by means of a spline, and a clutch disc 113, which is connected to the differential casing 101 by means of a spline.

When the ring gear and differential casing 101 rotate as one unit in response to the rotation of the drive shaft (located outside the figure) on the drive side, the pinion gears 105, side gears 107, multidisc clutch 109, etc. also rotate together. Therefore, the axle and wheels (located outside the figure) interlocked and connected to the side gears 107 also become rotated.

If one of the wheels (located outside the figure) slips, the side gear 107 connected to the axle (located outside the figure) on the slipping

side starts rotating against the differential casing 101, and the pinion gears 105 also rotate against the pinion shaft 103.

For example, if the wheel on the right side of Figure 1 slips, the clutch disc 111, which is connected to this side gear 107 by means of a spline, is prompted by the rotation of the side gear 107 on the same side to rotate faster than the clutch disc 113, which is connected to the differential casing 101 by means of a spline. Therefore, its movement is restricted by the clutch disc 113 by means of the action of the thrust force of the side gear 107 on the same side, and a torque is transmitted to the side gear 107 on the left side of Figure 2 by that much.

If the wheel on the left side of Figure 2 slips, a torque is transmitted from the differential casing 101 to the side gear 107 on the right side of Figure 2 as much as the braking force via the multidisc clutch.

Since the braking force of the multidisc clutch 109 is generated by using the thrust forces of the side gears 107 in the above device, the multidisc clutch 109 is sandwiched between the rear side of the side gears 107 and the sidewall of the differential casing 101. For this reason, when taking into account the size reduction of the differential casing 101, the storage space of the multidisc clutch 109 equipped inside the differential casing 101 is limited, and the clutch discs of the multidisc clutch 109 cannot be increased. Therefore, there is a limit to improving the differential limiting performance.

(C) Purpose of the Invention

This invention has been developed in light of the abovementioned problems, and its aim is to supply a limited slip differential capable

of improving the differential limiting performance while suppressing the size increase of the differential casing.

(D) Constitution of the Invention

To achieve the above aim, a limited slip differential of the invention consists of a pinion shaft, a pinion gear supported rotatably against the pinion shaft, a pair of side gears that are engaged with the pinion gear, a differential casing that contains the pinion shaft, pinion gear, and side gears, a clutch disc that is disposed between the side gears and differential casing and the outer periphery of which is engaged with the differential casing side, and a slip-limiting multidisc clutch that has clutch discs and the inner periphery of which is engaged with the side gear side, and is characterized by being equipped with an adaptor that has: a pressing part which is disposed in the space between the side gear side and clutch discs, which rotates together with the side gears, and which transmits the thrust forces of the side gears to the multidisc clutch; and an engaging part that engages with the inner periphery part of the clutch disc.

(E) Embodiment of the Invention

In the following, one embodiment of this invention will be described in detail with reference to drawings.

Figure 1 is a cross-sectional drawing of the limited slip differential, and its drive side is illustrated in roughly the same manner as in Figure 2, which illustrates the conventional example. The ring gears (located outside the figure) interlocked and linked with the drive shaft (located outside the figure) are affixed to the differential casing 1

and rotate together [with the casing].

Incidentally, the pinion shaft 3 that has both of its ends affixed to the differential casing 1 has a pair of pinion gears 5 rotatably attached to it. Side gears 7 that function as a pair of output gears that are engaged with these pinion gears 5 are rotatably disposed inside the differential casing 1. Moreover, the side gears 7 are interlocked and linked with /3 an axle (located outside of the figure) by means of spline connection.

Moreover, the boss parts 7a of the side gears 7 have an adaptor 9 affixed to them by means of keying or the like. This adaptor 9 is constructed in a manner such that its outer edge is positioned more inward than the back surfaces of the side gears 7 to form the pressing part 9a as illustrated in Figure 1. Moreover, the multidisc clutch 11 is disposed in the space between the pressing part 9a of the adaptor 9 and the sidewall 1a of the differential casing 1. This multidisc clutch 11 is made by alternately assembling the clutch disk 13, which is connected to the engaging part 9b of the adaptor 9 by means of a spline, and the clutch plate 15, which is connected to the differential casing 1 by means of a spline. Therefore, the clutch plate 15 and clutch disk 13 of the multidisc clutch 11 are positioned on the inner side than the rear surfaces of the side gears 7, and the frictional radius is large.

Next, the operation will be explained. In roughly the same manner as in the conventional example, the rotation of the ring gear (located outside the figure), which is connected to the drive side, causes the differential casing 1 to rotate. Since the rotation of the differential casing 1 results in the rotation of the pinion gears 5, side gears 7,

multidisc clutch 11, etc. contained inside the differential casing 1, the axle (located outside the figure) interlocked and connected to the side gears 7 as well as the wheel (located outside the figure) connected to the axle will also rotate.

At this time, if one of the wheels that is located outside the figure, such as the wheel on the right side of Figure 1, slips, the side gear 7 located on the right side of Figure 1 and linked with the axle (located outside the figure) on the slipping side starts rotating in response to the differential casing 1, and the pinion gears 5 also rotate around the pinion shaft 3.

The rotation of these side gears 7 causes the adaptor 9 affixed to the side gears 7 to also rotate together. This rotation of the adaptor 9 prompts the clutch disk 13 to rotate faster than the clutch plate 15. At this time, the thrust forces of the side gears 7 are transmitted to the multidisc clutch 11 via the pressing part 9a of the adaptor 9, the movement of the clutch disk 13 becomes limited by the clutch plate 15, and the differential becomes limited.

Furthermore, this invention is not limited to the abovementioned one embodiment. For example, it is permissible to integrate the adaptor 9 with the side gears 7.

(F) Effects of the Invention

As is clear from the above explanation, this invention can increase the number of multidisc clutches without widening the gap between the sidewall of the differential casing and side gears, and can also increase the frictional radius. Therefore, an effect can be attained in that the

differential limiting performance can be improved while preventing the differential casing from increasing in size.

4. Brief Description of the Drawings

Figure 1 is a cross-sectional drawing of a limited slip differential pertaining one embodiment of this invention, and Figure 2 is a cross-sectional drawing of a conventional limited slip differential.

(Explanation of the Reference Numerals that Denote the Essential Parts of the Drawings)

1 = differential casing

3 = pinion shaft

5 = pinion gear

7 = side gear

9 = adaptor

11 = multidisc clutch

13 = clutch disc

14 = clutch plate

Figure 1

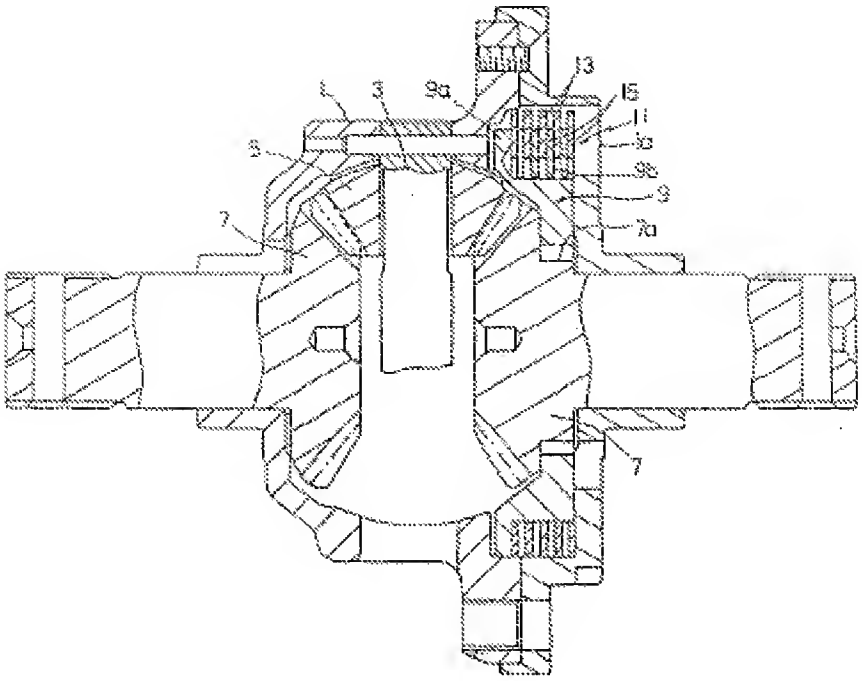

Figure 2